DMIS

A Data Exchange Protocol for Dimensional Measurement

Status & DMIS 5.0 Update

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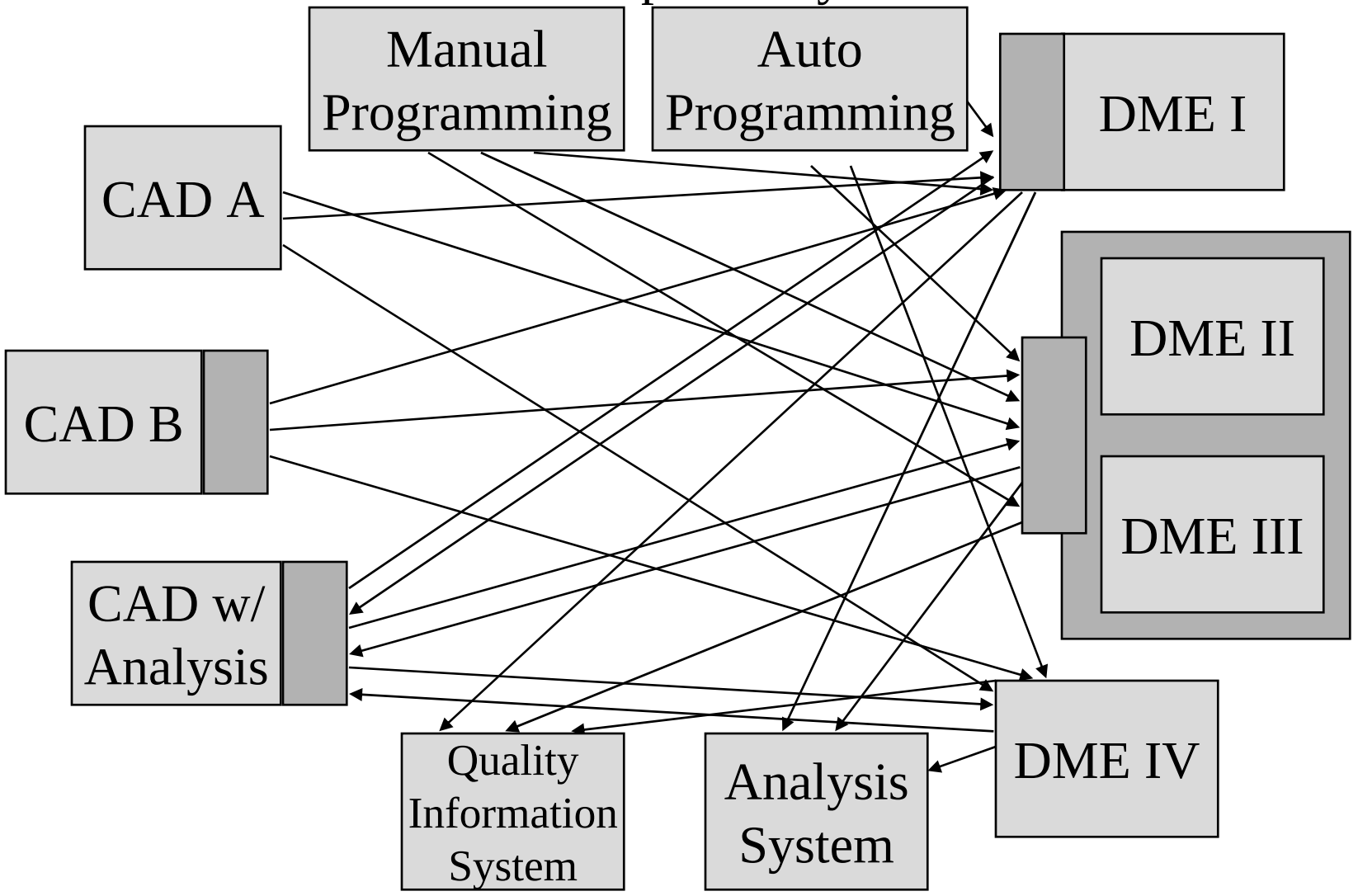
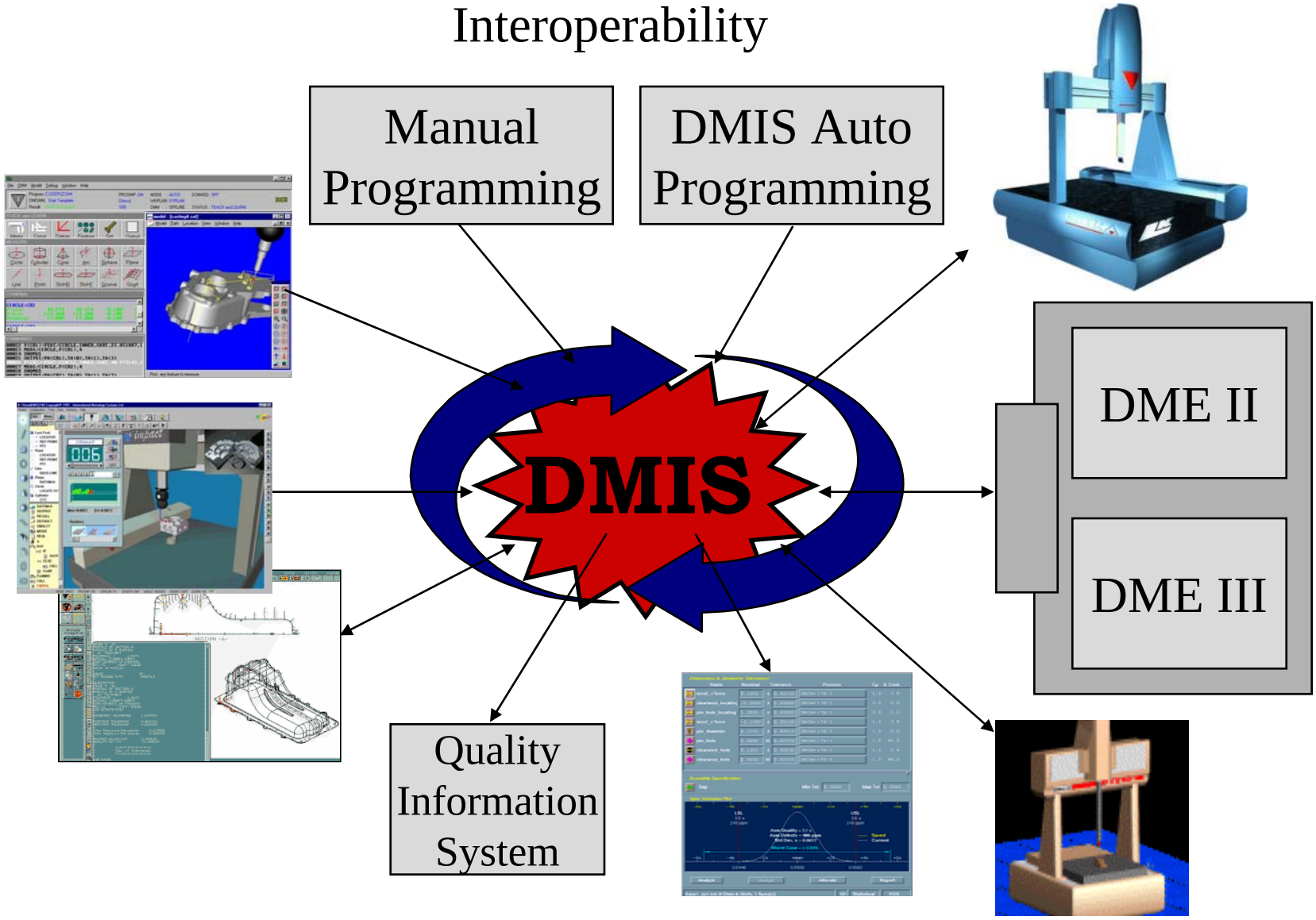
Pre-DMIS Environment

Classic Interoperability Problem



DMIS Environment

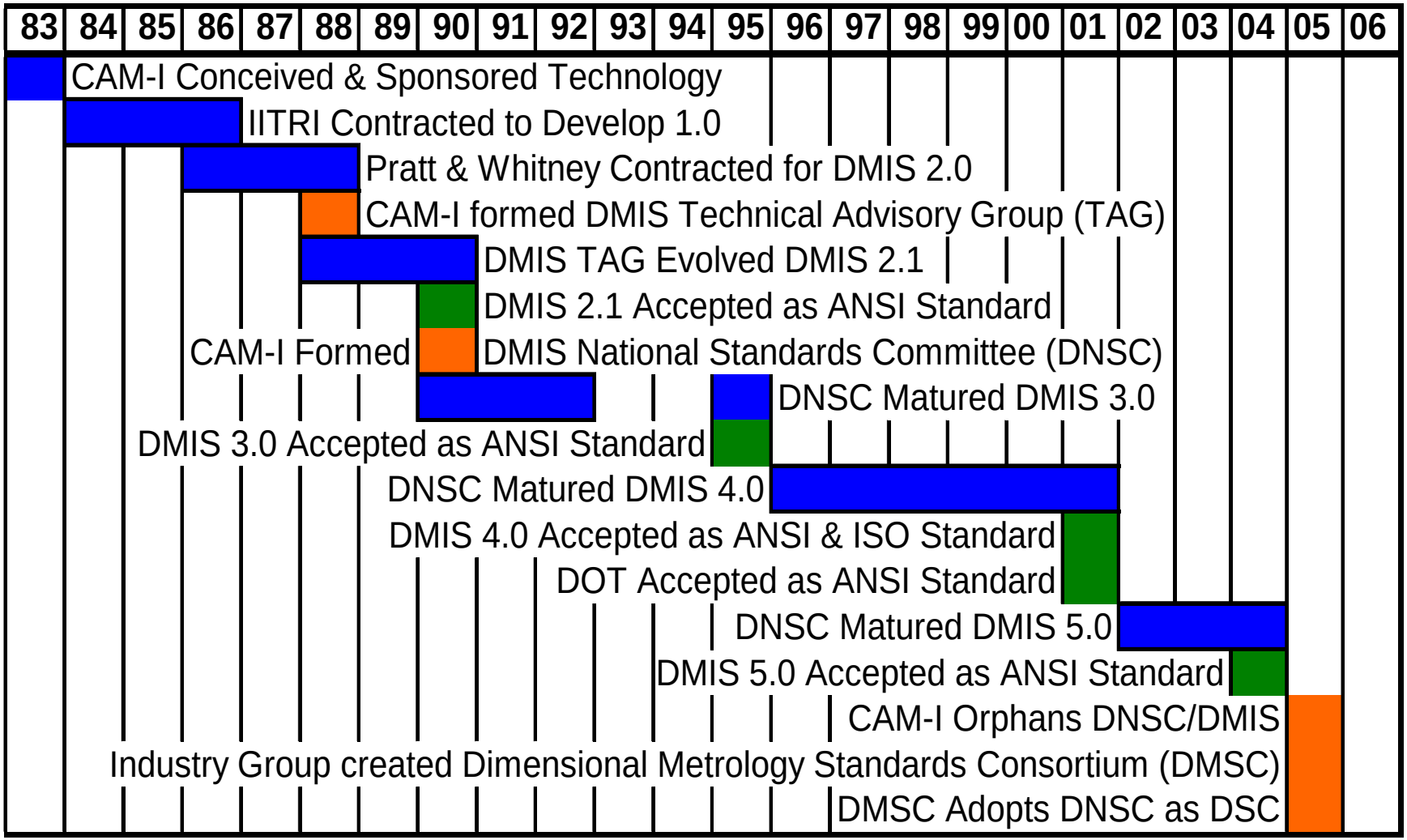
Interoperability



What is DMIS?

- **Fulfillment of a Technology Void**
- **Standard of Bi-directional Communication for Dimensional Measurement Data**
- **Specifies a Vocabulary of Terms**
  - Metrology Measurement Programs
  - Measurement Results Data
- **Neutral Exchange Format**
- **Human Readable and Writeable**
- **Function as DME Language**
- **American & ISO Standard**

DMIS Timeline



Dimensional
Measuring
Interface
Standard

- Over 140 improvements (Interpretations, Errors, Enhancements)
- Harmonization with STEP and DML specifications
- Replaced Contact and Non-Contact Scanning (EDUG)
- Complete Suite of Measurement Features
- Continued Alignment with GD&T Standards
- Introduction of Measurement Uncertainty
- Removed Ambiguities:
  - Major and Minor Words;
  - Example Codes,
  - Macros,
  - Diagrams
- DMIS Application Profiles and Conformance Levels
- Approved as ANSI Standard
- Submitting as International Standard

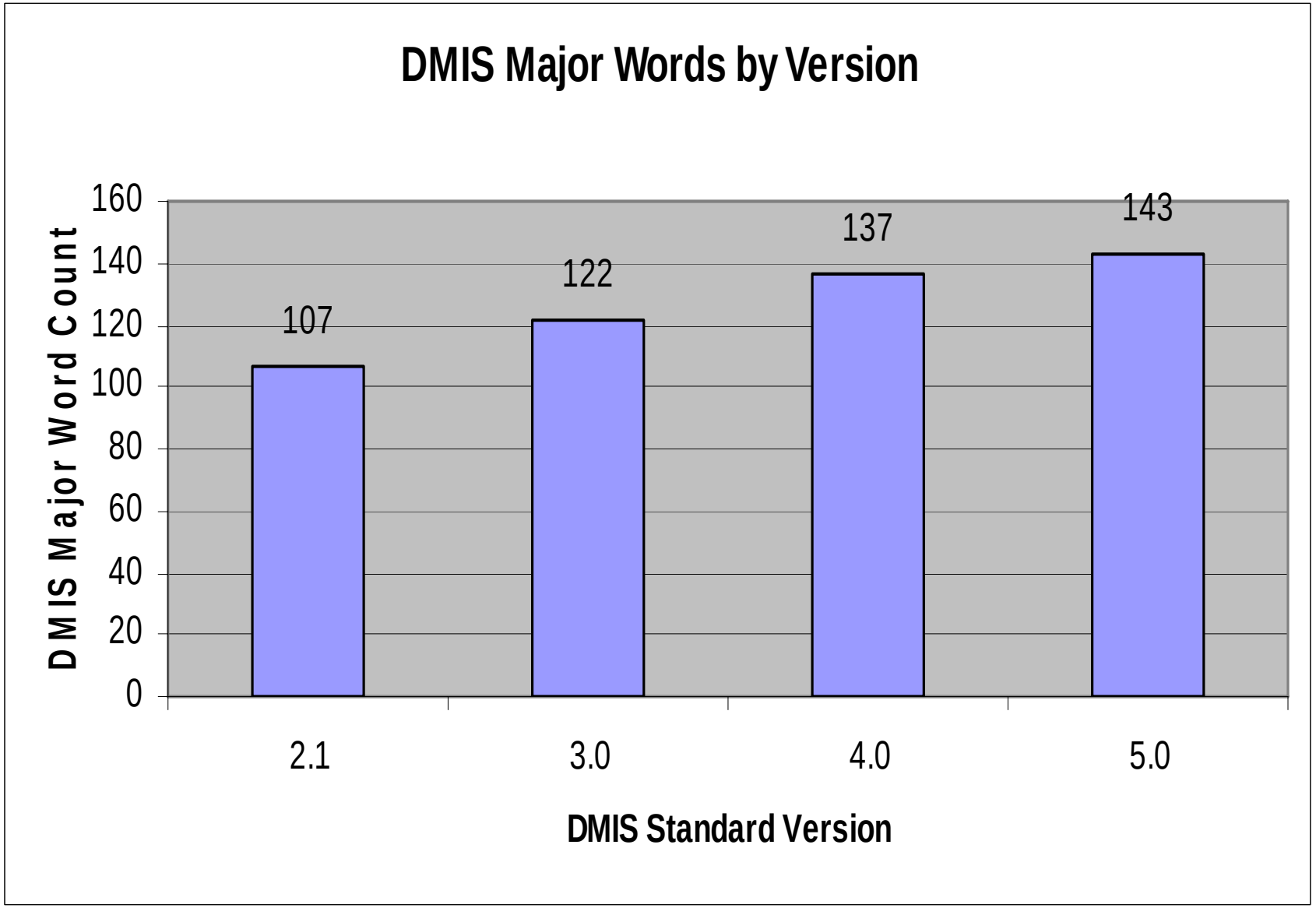
DMIS

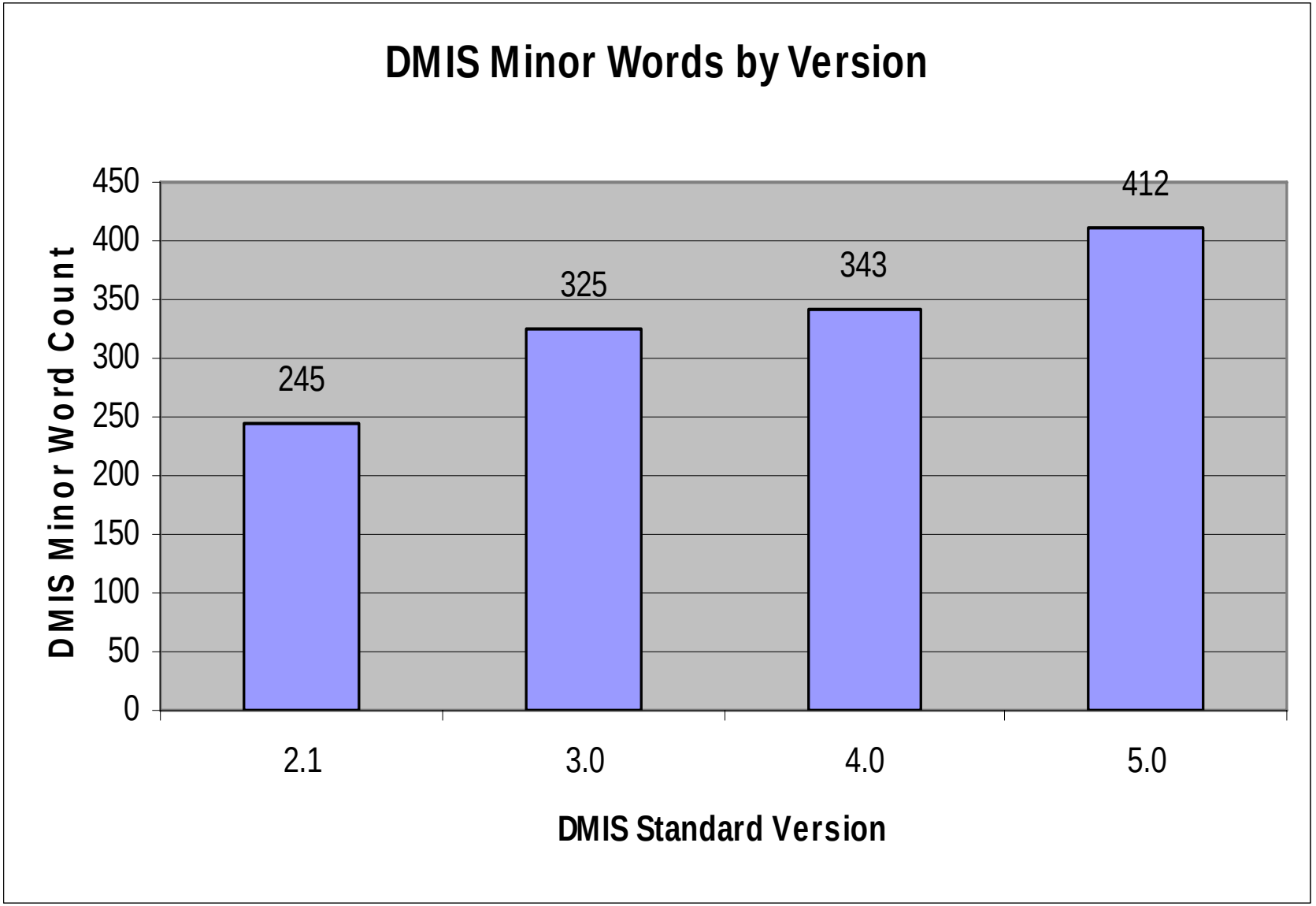
Objective

- The new and improved version of the Dimensional Measuring Interface Standard (DMIS), revision 5.0, has more than 140 enhancements over DMIS version 4.0 (approved 2001) including: Enhanced Scanning; a Completed Suite of Measure Features; Continued Alignment with GD&T Standards; an Introduction to Measurement Uncertainty; the addition of major and minor words; example codes, macros, diagrams that remove ambiguities, and much more.
- The objective of the Dimensional Measuring Interface Standard (DMIS) is to provide a standard for the bi-directional communication of inspection data between computer systems and inspection equipment. The standard is a vocabulary of terms, which establishes a neutral format for inspection programs and inspection results data.
- While primarily designed for communication between automated equipment, DMIS is designed to be both man-readable and man-writable, allowing inspection programs to be written and inspection results to be analyzed without the use of computer aids. With the enhancement of the High Level Language extensions, DMIS can function and be implemented as a DME (Dimensional Measuring Equipment) language.
- DMIS provides the vocabulary to pass inspection programs to dimensional measuring equipment and to pass measurement and process data back to an analysis, collection, and/or archiving system. A piece of equipment which interfaces to others, using the DMIS vocabulary, may do so directly or it may have a pre-processor to convert its own native data formats into the DMIS format and/or a postprocessor to convert the DMIS format into its own data structure.

DMIS 5.0 Update

- **Update**
  - **Robust Scanning Support**
  - **Complete Feature Set**
  - **Enriched Tolerances**
  - **Measurement Uncertainty**
  - **More Complete and Unambiguous**
- **Approved as ANSI Standard**
- **Submitted as ISO Standard**


DMIS Major Words by Version
DMIS Major Word Count
160
140
120
100
80
60
40
20
0
107
122
137
143
2.1
3.0
4.0
5.0
DMIS Standard Version


DMIS Minor Words by Version
DMIS Minor Word Count
450
400
350
300
250
200
150
100
50
0
245
325
343
412
2.1
3.0
4.0
5.0
DMIS Standard Version

Current Validated SIRs

November 21, 2005

SIR No.	Submit Date	Submitted By	Company	Problem Type	Topic	Status	Status Date
98-104	December 1 1998	Ron Schall	Ford Motor	Enhancement	Lack of Gear Measurement Capability	Validated	February 9 2000
99-84	March 9 1999	Dave Petrizze	Wilcox Associates, Inc.	Enhancement	Machine Parameters	Validated	March 15 1999
99-123	November 10 1999	Ron Schall	Ford Motor Co	Enhancement	Inabilty to inspect threaded features.	Validated	November 10 1999
17-Mar	July 29 2003	Keith Morton	LK Metrology	Other	Add table of applicable TOL statements for FEAT statements	Validated	July 29 2003
03-Apr	January 20 2004	Lutz Karras	Carl Zeiss	Error	Impossible to use SGAGE and SPART	Validated	January 20 2004
Apr-50	April 30 2004	Cory Leland	Deere & Company	Error	Removal of Scan -- Path -- Points	Validated	April 30 2004
Apr-51	December 16 2004	yjlee	Freelancer	Enhancement	Need TOL/LEN statement	Validated	December 16 2004
01-May	July 27 2005	Lutz Karras	EDUG	Error	Description of FEAT / LINE incomplete	Validated	August 27 2005

As of March 27, 2006: **49** Validated SIRS

DMIS Conformance

- **DNSC Recognized:**
  - **The Difficulty of Using Past DMIS CHFiles for Evaluating Conformity.**
  - **The Necessity of Guaranteed Interoperability between DMIS Systems.**
  - **That Most DMIS Applications do not Need to Implement the Entire Standard.**
  - **A Need to Define a DMIS Validation Mechanism.**
- **MIPT Initiated**
  - **Efforts to define DMIS Application Profiles**
  - **Solicitation of DNSC Participation**
- **NIST Participating**
  - **Define Conformance Testing Algorithms & Processes**
  - **Conduct Testing Pilot**

Application Profile Development

- Proposed as AIAG Work Request. Steps include:
  - Discuss common user needs and decide on an application area for which to develop an application profile (e.g., prismatic, sheet metal, etc.)
  - Identify and agree upon the subset of DMIS functionality needed to meet the requirements (define the application profile)
  - Engage vendors and get their input on the application profile (reasonableness, implementation issues, how it fits with their plans etc.)
  - Encourage implementation of the application profile
  - Develop conformance test tools and suites to evaluate conformance of implementations to the application profile (NIST lead)
  - Conduct testing pilot of application profile implementations, using Metrology Testbed equipment and software at industry, NIST, and university sites

DMIS Conformance Process

- Define Application Profiles (AP)
- Approve and Publish APs
- Develop AP Conformance Testing Suite
- Recognize DMIS Conformance Testing Service
- Submit DMIS Application for Adherence
- Make Application’s DMIS Conformance Claim

DMIS 5.0 Application Profile

- **DMIS Applications Profiles (AP)**
- **Application Profile Addendums (APA)**
- **APA appends to an AP**
- **With DMIS 5.0 Conformance Levels**
  - Level 1: Essential
  - Level 2: Important
  - Level 3: Beneficial
- **DMIS 5.0 Reference Section 2.1**

DMIS 5.0 Application Profiles Defined

Application Profiles

- **Prismatic**
- **Thin Walled**

- **Application Profile Addendums**
  - **Rotary Table**
  - **Contact Scanning**
  - **MultiCarriage**
  - **In-Process Verification (IPV)**
  - **Quality Information System (QIS)**
  - **Soft Gauging**
  - **Measurement Uncertainty**

DMIS 5.0 Application Profile

(MS Excel Format)

			Prismatic Application Profile				Thin Walled Application Profile				Rotary Table AP Addendum			Multi Carriage AP Addendum			Contact Scanning AP Addendum			IPV AP Addendum			QIS AP Addendum			Meas Uncert ty AF Addenc	
	L1	Essential to meeting the Profile's goals																								
	L2	Important to meeting the Profile's goals																								
	L3	Beneficial to meeting the Profile's goals.																								
	N/A	Not applicable to this Profile																								
COMMAND	PARAMETERS		L1	L2	L3	N/A	L1	L2	L3	N/A	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2
ACLRAT	ACLRAT/var_1				x				x				x														
	var_1	MESACL,var_2			x				x																		
		POSACL,var_2			x				x																		
		ROTACL,var_3				a				a			x														
	var_2	MPMM,n			x				x																		
		MMPSS,n			x				x																		
		IPMM,n			x				x																		
		IPSS,n			x				x																		
		var_4			x				x																		
	var_3	RPMM,n				a				a			x														
		var_4				a				a			x														
	var_4	PCENT,n			x				x				x														
		HIGH			x				x				x														
		LOW			x				x				x														
		DEFAULT			x				x				x														
ALGDEF	¥A(label)=ALGDEF/var_1					x				x																	
	var_1	CODE,n				x				x																	
		'name' var_2				x				x																	
	var_2	,parameter var_2				x				x																	
ASSIGN	varname=ASSIGN/expr			x	x			x	x																		
BADTST	BADTST/var_1			x	x			x	x																		
	var_1	ON		x	x			x	x																		
		OFF		x	x			x	x																		
BOUND	BOUND/var_1 var_2 var_3		x	x	x			x	x																		
	var_1	F(label1)	x	x	x			x	x																		

DMIS 5.0 Conformance Claim

Example

- **Our Product, Version x.y from DMIS Vendor conforms to:**
- **DMIS Application Profile**
  - **Prismatic, Level 3 and**
  - **Thin Wall, Level 2**
- **With:**
- **AP Addendum**
  - **Rotary Table, Level 3.**

DMIS 4.0:

- Rewrote the DMIS CHFile using the Extended Bakus Naur Format (EBNF)
- Addressed Conformance in the Specification
- Identified Conformance Testing Services
  - To Validate CHFiles
  - To Test Conformance
- Defined an Approach to Insure DMIS Conformity within a DMIS Functional Subset.

DMIS Application Profiles

- Required for DMIS Conformance Testing
- Used to Defines Functional Subsets
- Contains Conformance Levels
  - Level 1: Essential
  - Level 2: Important
  - Level 3: Beneficial
- Must be Formulated, Agreed, and Submitted
- Formally Recognized by DNSC
- Currently none have been Formally Recognized or Submitted

Application Profile Representation

- Currently no Templates have been Defined.
- Define using DMIS 4.0 CHFile EBNF for Easier Comparisons with System’s CHFile.
- Designate Conformance Levels within the Application Profile Bends .

Conformance Testing Service

- Can be Provided any Organization.
- Service to be Recognized by the DNSC.
- Develops Test Suites to:
  - Validate Chile
  - Test DMIS Implementations for Conformity to One or More Application Profiles.
- Currently, No Conformance Testing Service Exist.

DMIS Conformance Testing

- Verify syntax of DMIS input and output files
- Verify that a generator produces conforming metafiles which accurately and correctly represent the intended results
- Verify that an interpreter can correctly and completely read conforming metafiles and produce intended results
- Verify that the DMIS characterization file is syntactically correct and that it accurately represents the capabilities of the application
- Conforming implementation must adhere to prescribed syntax **and** semantics

Conformance Claim

- **OurProduct, Version x.y from DMISVendor conforms to DMIS Application Profile ABC, Level 2 and XYZ, Level 3.**

DMIS +’s and –’s

+’s :

- Maintained and improved by committee
- Mature, an existing standard
  - many successful implementations
- Full featured

-’s :

- Maintained and improved by committee
- Old
- Overlap with emerging standards

DMIS Future Direction

- Continued efforts at harmonization
  - STEP AP's
  - I++
  - DML
- Modernization of high level language support (HLL)?
- Shrinkage?

DMIS Application Profiles & Conformance Testing

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